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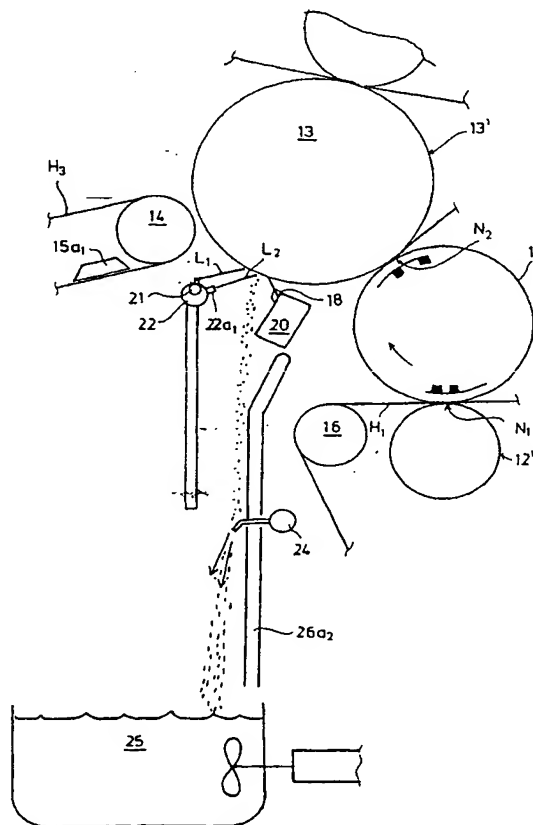
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(54) Title: EQUIPMENT AND METHOD FOR PASSING A PAPER/BOARD WEB INTO A PULPER

(57) Abstract

The invention concerns an equipment and a method for passing a paper/board web into a pulper. The equipment comprises a needle-nozzle pipe (22) in connection with a roll (13), out of which needle-nozzle pipe needle-like water jets are applied into connection with the paper/board web (W) when the web is passed into the pulper, and the web is disrupted by means of the needle-like jets.



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Equipment and method for passing a paper/board web into a pulper

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The invention concerns an equipment and a method for passing a paper/board web into a pulper.

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The tendency of passing a web under a doctor blade is increased when the machine speeds become higher and when the basis weight of the web becomes lower.

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When a web meets a doctor blade, there is a great risk that the web penetrates fully under the doctor blade. In order to prevent this and in order to facilitate the possibilities of operation of a doctor blade, needle jets are applied, which jets disrupt the web before it arrives at the doctor blade. Needle-like jets are applied at a high pressure from a jet pipe onto the web face, and in this way the web is disrupted and a layer of water is produced between the roll and the web, in which case separation of the web by means of the doctor blade is facilitated considerably. Further, the needle jet can be oscillating, in which case the effect of disruption is distributed evenly over the roll face, and the needle jets also keep the roll face clean. Before the needle jets, the equipment may comprise jets in themselves known which moisten the web, in which case the disruption of the web by means of the intensive water jets is facilitated. When the roll face is kept clean by means of needle jets, this further promotes the operation of the doctor blade proper, in which connection the reliability of the operation of said doctor blade is increased. For the disrupting needle jet, it is favourable to use a part of the water entering into the pulper jets in themselves known. To the tip of the blade, a sharp air jet is applied across the entire width of the machine. The air jet separates the web from the roll before the blade tip and thereby prevents formation of a situation in which the web passes under the doctor blade. The separation is facilitated by the air cushion formed under the web. In view of limitation of the quantity of air, the nozzle has been arranged near the tip of the blade and connected with an automatic system so that blowing of air is switched on

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exclusively when the web arrives at the doctor. In view of preventing blocking of the nozzles, the "upper lip" of the nozzle is resilient and is opened during blowing and closed when the blowing stops. Along with the air, it is also possible to supply water so as to moisten the blade.

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In the present patent application, it is suggested further that the front face of the blade be coated, for example, with "teflon" so that the friction between the web and the doctor blade of the doctor is reduced, in which case the possibility of the web being wedged between the roll face and the blade is reduced. The passing of the web
10 into the pulper can be enhanced further by means of a solution of equipment in which a guide jet, for example an air jet or a water jet, attracts the web along with it by means of a Coanda effect, and said jet is directed down towards the pulper, in which connection guiding of the web into the pulper is promoted by means of a draw produced by said Coanda effect. The draw produced in this way, together with the
15 jet applied to the tip of the blade, already separates the web before the blade and prevents formation of a situation in which the web passes under the blade. Further, the operation of the doctor can be improved by means of a separate jet placed at the front side of the doctor blade. The jet keeps the roll face and the blade clean.

20 The equipment and the method in accordance with the invention for passing a web into a pulper are characterized in what is stated in the patent claims.

The invention will be described in the following with reference to the accompanying figures and to the embodiments illustrated in said figures, the invention being,
25 however, not supposed to be confined to said illustrations and embodiments alone.

Figure 1 is a schematic illustration of a solution of equipment in accordance with the invention.

30 Figure 2 illustrates the use of guide jets.

Figure 3A shows an embodiment of the invention in which a bellows with a resilient cover has been formed in connection with the doctor blade, through which bellows a jet of a medium, for example a jet of air or water, is passed to the vicinity of the forward edge of the doctor blade.

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Figure 3B shows a second embodiment of the construction shown in Fig. 3A, in which the resilient bellows has been formed out of a resilient plate, which has been attached to a pipe through which the medium is introduced.

10 Figure 3C shows an embodiment of the invention in which the nozzle pipe for the water jet is connected with the interior of the doctor beam, and

Figure 3D shows a construction in which the nozzle pipe for the water jet has been attached to the face of the doctor beam.

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Figure 3E is a sectional view taken along the line I—I in Fig. 3A.

Figure 4A shows an embodiment of the invention in which the paper web is disrupted by means of needle jets before the web reaches the doctor blade.

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Figure 4B shows a solution in which, before the needle jets, a moistening jet is applied to the face of the web, in which connection, by means of the needle jets, disruption of the web can be accomplished more efficiently and with lower water pressures.

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Figure 4C shows an embodiment of the invention in which the nozzle pipe 22 that produces the needle jets L_2 is oscillated in the axial direction of the roll 13 so as to increase the web disrupting efficiency.

30 Fig. 1 shows a pick-up roll 10, whose different positions are detected by means of an identifying detector d_1 . From the identifying detector d_1 there is a signal line e_1 passing to control units that control the spraying of medium. The web arrives from

the former F over the pick-up roll 10 in between fabrics H_1 and H_2 , and it is carried further into a nip N_1 formed between a lower grooved roll 12' and an upper suction roll 12 and further, along the face of the suction roll 12, along with the fabric H_2 passed on the face 12 of the suction roll onto a centre roll 13, and the web W, which adheres to the face of said centre roll 13, is passed further onto a guide roll 14 in the dryer section K and into the first group R_1 of drying cylinders in the dryer section K. In a normal running situation, the web W is passed along with the drying fabric H_3 , and by means of a hold suction produced by suction boxes 15a₁ and 15a₂, the web W is kept in contact with the lower face of the fabric H_3 and passed onto the first drying cylinder K_1 and further from the drying cylinder K_1 onto the suction cylinder S_1 (of the VacRoll type).

The guiding of the fabric H_1 takes place over the guide rolls 16 and 17.

15 In accordance with the invention, onto the lower face of the centre roll 13, a doctor blade 19 has been fitted, which services the roll and is in contact with the roll face 13' and which is placed in its blade holder 18, which holder is further mounted on a doctor beam 20.

20 When the machine is being started and in the event of standstills and web breaks, the web must often be guided down into the pulper 25, after which the lead-in strip can be drawn through the break point and the web spread, in a way in itself known, to its full width. When the web W is guided from the centre roll 13 into the pulper 25, this takes place, in accordance with the prior art, so that a doctor blade 19 which is in contact with the face 13' of the centre roll 13 is used as an aid. By means of the doctor blade 19, passing and winding of the web W around the centre roll is prevented, because it is the doctor blade 19 that separates the web W from the face 13' of the centre roll 13.

30 It is suggested in the present patent application that, when the web W is run into the pulper 25, the web W is disrupted by means of needle-like water jets applied from a needle-nozzle pipe 22.

The needle-nozzle pipe 22 is placed before the doctor blade 19, and a nozzle pipe 21 that moistens the web, which pipe is in itself known, is placed preferably so that it sprays a jet L_1 that moistens the web before the needle jets L_2 .

- 5 In connection with the pulper container 25, there are guide walls $26a_1$ and $26a_2$ placed above the container and, in connection with said walls, there are water guide nozzles 23 and 24 in themselves known, through which dilution water is passed onto the walls $26a_1, 26a_2$ in order to keep the walls clean.
- 10 From the white-water tank 27, white water is passed by means of a pump 28 into a trunk line 29, from which trunk line 29 there is a branch line $30a_1$. The branch line $30a_1$ is branched further into the branch lines $30a_2, 30a_3$, and $30a_4$. In the branch line $30a_4$ there is a remote controlled control valve $31a_1$, and in the branch lines $30a_3$ and $30a_5$ there are remote-controlled control valves $31a_2$ and $31a_3$. By means
- 15 of the valves $31a_1, 31a_2$ and $31a_3$, the flow of water to the water nozzles $50a_1, 50a_2, 50a_3$ provided at the ends of the branch lines is regulated. Before the press, in connection with the pick-up roll 10, there is a detector d_1 , which detects the position of the pick-up roll and from which a signal line e_1 passes to the control unit $32a_1$, and in the first group R_1 of drying cylinders in the dryer section K, below the
- 20 suction cylinder S_1 , there is an identifying detector d_2 , which monitors the web W and from which a signal line e_2 passes to the control unit $32a_1$, which controls the main valve $31a_4$ of the branch line $30a_1$. Thus, by means of the detectors d_1 and d_2 it is detected in which mode of operation the machine is and whether the web W is placed, for example, in connection with the identifying detector d_2 . If the web is not
- 25 placed in connection with the identifying detector d_2 and the pick-up roll 10 is, nevertheless, in an operating position and this is reported by the detector d_1 , the web is passed into the pulper 25 and, thus, the valves $31a_1, 31a_2, 31a_3$ receive the controls for spraying of the medium, in particular of water. Through the control unit $32a_2$, the valves $31a_1, 31a_2$ and $31a_3$ are controlled, and through the control unit $32a_1$ the
- 30 main valve $31a_4$.

Fig. 2 shows an embodiment of the invention in which guide jets S_1, S_2, S_3 are employed. The guide jets S_1, S_2 and S_3 can be favourably, for example, air jets. It is, however, also possible to employ liquid jets, preferably water jets. In the case of medium jets, the jets S_1 and S_2 provide the effect that the web is affixed, by means of a Coanda effect, to the jets, and the web is drawn into the pulper. The jets S_1 and S_2 have been directed from the nozzles $50a_1$ and $50a_2$ towards the pulper. The jet S_3 applied from the nozzle $50a_3$ in connection with the doctor blade 19 is favourably an air jet, and by its means formation of a vacuum is prevented in the gap O at the outlet side between the guided web W and the roll 13 face. The jet S_3 replaces the air that has been removed by the web W from the gap O. The medium in the jet S_3 is preferably air. However, it is possible to use air or water as a medium in the jets S_1, S_2 and S_3 .

Fig. 3A shows an embodiment of the invention in which the doctor blade 19 is connected with a blade holder 18. The blade holder 18 is further connected with a doctor beam 20. Loading hoses 33 and 34 pivot the blade holder 18 around an articulated joint 35. The front plate 18' of the blade holder 18 is connected with a bellows 37 made of a resilient shield cover, out of whose interior space the medium jet S_3 of the nozzle $50a_3$ is applied, favourably an air jet, to the forward tip of the doctor blade 19. The resilient shield cover 37 is provided with a nozzle opening 38, which is opened by the effect of pressure, in which connection, when pressure is applied to the interior of the resilient shield cover 37, the medium jet S_3 , preferably an air jet, is passed through the nozzle opening 38 to the tip of the blade 19.

The flow duct formed between the resilient shield cover 37 and the front plate 18' is favourably formed so that a throttle is formed in the duct before the nozzle opening. This has an effect that stabilizes the opening of the nozzle opening in the cross direction of the machine. When the opening tends to become larger, the pressure in the duct is reduced, which attempts to make the opening smaller. In a corresponding way, when the opening is closed, the pressure in the duct is increased, which attempts to open the nozzle opening. The stabilizing is enhanced by making the flow in the cross direction of the machine more difficult, for example,

by providing the throttle area in the duct with grooves fitted in the machine direction or with a corresponding set of ducts 37'.

- Fig. 3B shows an embodiment in which the pipe 40 comprises a flexible plate 34 in its connection, in which case, when pressure is passed through a flow opening 42 provided in the pipe 40 into connection with the plate 34, the plate is displaced, and the space between the plate 34 and the blade holder is opened so as to spray a medium to the tip of the blade 19.
- Fig. 3C shows an embodiment in which the nozzle pipe 43 is placed inside the doctor beam 20, in which case a medium jet S_3 is passed through an opening provided in the doctor beam towards the blade 19 tip and into connection with the face 13' of the centre roll 13.
- Fig. 3D shows an embodiment in which a nozzle pipe 43 has been fitted onto the face of the doctor beam 20, through which pipe 43 a medium jet S_3 is passed in a way similar to that in the embodiment illustrated in Fig. 3C.

Fig. 3E is a sectional view taken along the line I—I in Fig. 3A.

- Fig. 4A shows an embodiment of the invention in which a jet pipe 22 produces needle jets L_2 so as to disrupt the web W on the face 13' of the centre roll 13. Before the jet pipe 22, there is a jet pipe 21, by whose means moistening jets L_1 are passed into connection with the web W, in which connection, by means of the needle jets L_2 , the web, which has already been moistened, can be disrupted readily by means of the needle jets passed at a high pressure out of the nozzles 22a₁, 22a₂.... Further, the jet pipe 22 can be oscillated in the cross direction of the web by means of a separate actuator, in which way the effect of the needle jets L_2 is enhanced. Favourably, as the medium, white water is used which has been taken as retention from the wire, so that part of the dilution water of the pulper is passed to the jet L_2 .

Fig. 4B is an axonometric view illustrating the equipment of disrupting the web W. As is shown in the figure, a high-pressure needle jet L_2 is produced from each nozzle $22a_1, 22a_2, 22a_3 \dots$ of the jet pipe 22. Before the needle jet L_2 , onto the roll 13 face 13', into connection with the web W, a jet L_1 which moistens and softens the web W is sprayed out of the nozzle pipe 21. The pipe 22 can be favourably fitted in connection with a conventional pipe 21, as is shown in the figure, or it can be arranged as a separate pipe. In both solutions, as the medium jet, it is possible to use water that has been derived as retention from the wire.

10 In the moistening jets 21, fresh water is usually used because of the small size of the nozzles.

Fig. 4C shows an embodiment of the invention in which the nozzle pipe 22 which produces the needle jets L_2 is oscillated in the axial direction of the roll 13 in the way indicated by the arrow J_1 . In this way, the disruption of the web W produced by means of the needle jets is enhanced further. Thus, in the solution of equipment in accordance with the present invention, when the web is passed into the pulper 25, it is first passed in the ordinary way from the doctor blade 19 of the doctor, and, additionally, medium jets S_1, S_2, S_3 are used as an aid, of which jets the jet S_3 is preferably an air jet. After a certain running time, the operation of the jets S_1, S_2, S_3 is stopped, and the web W to be passed into the pulper is disrupted by means of the needle jets L_2 , and to the forward side of the point of impingement of said needle jets a jet L_1 that moistens the web W is passed. The jets L_1 moisten the web W before the needle jets L_2 , in which case the needle jets L_2 do not require an equally high spraying pressure.

As an alternative, it is possible to use the jet L_2 together with the jet L_1 or without said jet as soon as the web arrives at the doctor blade. It is also possible to use the medium jets S_1, S_2 and S_3 alone or as different combinations. In order to avoid a situation in which the web passes under the doctor blade, the front face of the doctor blade 19 can be coated with "teflon" or with a fluoropolymer or with any other material that reduces the friction.

Claims

1. An equipment for passing a paper/board web into a pulper, **characterized** in that the equipment comprises a needle-nozzle pipe (22) in connection with a roll (13), out of which needle-nozzle pipe needle-like water jets are applied into connection with the paper/board web (W) when the web is passed into the pulper, and that the web is disrupted by means of the needle-like jets.
2. An equipment as claimed in claim 1, **characterized** in that the needle-nozzle pipe (22) comprises a number of nozzles (22a₁, 22a₂, 22a₃), out of which preferably a water jet is passed at a high pressure into connection with the web (W), which web (W) has been passed along the face of the roll (13) so that, besides disrupting the web (W), the water jet also keeps the roll face (13') clean.
3. An equipment as claimed in any of the preceding claims, **characterized** in that, in the vicinity of the needle-nozzle pipe (22), preferably at its forward side, there is a second nozzle pipe (21), through which a jet (L₁) that moistens the web (W) is passed before the needle jets (L₂), in which connection, by means of the moistening jet (L₁), the disruption of the web by means of the needle jets (L₂) is enhanced.
4. An equipment as claimed in any of the preceding claims, **characterized** in that, along the discharge path passing into the pulper, there are nozzles (50a₁, 50a₂) for application of guide jets (S₁ and S₂) towards the pulper (25), in which connection the web (W) is drawn by means of the jets (S₁ and S₂) and of the Coanda effect produced by said jets into the pulper (25) while the web (W) is affixed to the jets by the Coanda effect and drawn towards the pulper (25) by means of the jets.
5. An equipment as claimed in any of the preceding claims, **characterized** in that there is a separate jet (S₃) in connection with the doctor blade (19) placed against the roll (13), by means of which jet (S₃) the tip of the doctor blade (19) is kept clean and passing of the web (W) into the pulper is promoted without colliding of the web against the blade tip.

6. An equipment as claimed in the preceding claim, **characterized** in that the jet (S_3) is favourably an air jet, in which case the air acts as a guide for the web (W) to be passed into the pulper (25) and acts as replacement air in the gap (O) between the web (W) separated from the face of the roll (13) and the roll (13) face (13').

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7. An equipment as claimed in any of the preceding claims, **characterized** in that the air jet (S_3) is produced from the interior of a resilient shield cover (37) placed in connection with the frame of the doctor blade, which shield cover (37) comprises a nozzle opening (38) which is opened by the effect of pressure, in which connection, when the pressure is passed into the interior of the resilient shield cover (37), a medium jet (S_3), favourably an air jet, is passed through the nozzle opening (38) towards the tip of the blade (19).

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8. An equipment as claimed in the preceding claim, **characterized** in that, in connection with the doctor blade (19), there is a pipe (40), to which a plate (34) has been attached, and that, when a pressurized medium is passed through a flow opening (42) provided in the pipe (40) into connection with the plate (34), the plate is displaced and a space between the plate and the blade holder is opened so as to spray the medium towards the tip of the blade (19).

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9. An equipment as claimed in any of the preceding claims, **characterized** in that the roll (13) is the centre roll in the press of a paper machine and that the doctor blade (19) is placed on the lower face of the centre roll (13) and that, at the forward side of the doctor blade (19), there is the needle-nozzle pipe (22) which produces the needle jets (L_2).

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10. An equipment as claimed in any of the preceding claims, **characterized** in that the front face of the doctor blade (19) has been coated with "teflon" or with a fluoropolymer or with any other material that reduces the friction.

30

11. A method for passing a paper/board web into a pulper, **characterized** in that, in the method, owing to a web break or out of some other reason, the paper or

board web (W) is passed into the pulper (25) from the centre roll (13) of the press of a paper/board machine, and that in the method, in view of facilitating the doctoring and preventing running of the web under a doctor blade, the web (W) is disrupted by means of a needle jet (L_2), which is applied onto the web (W) face in connection with the roll (13), in which connection the needle jets (L_2) additionally keep the roll (13) face (13') clean.

12. A method as claimed in claim 11, **characterized** in that, in the method, passing of the web past the doctor blade (19) is prevented so that a medium jet, preferably an air jet, is passed to the tip of the doctor blade.

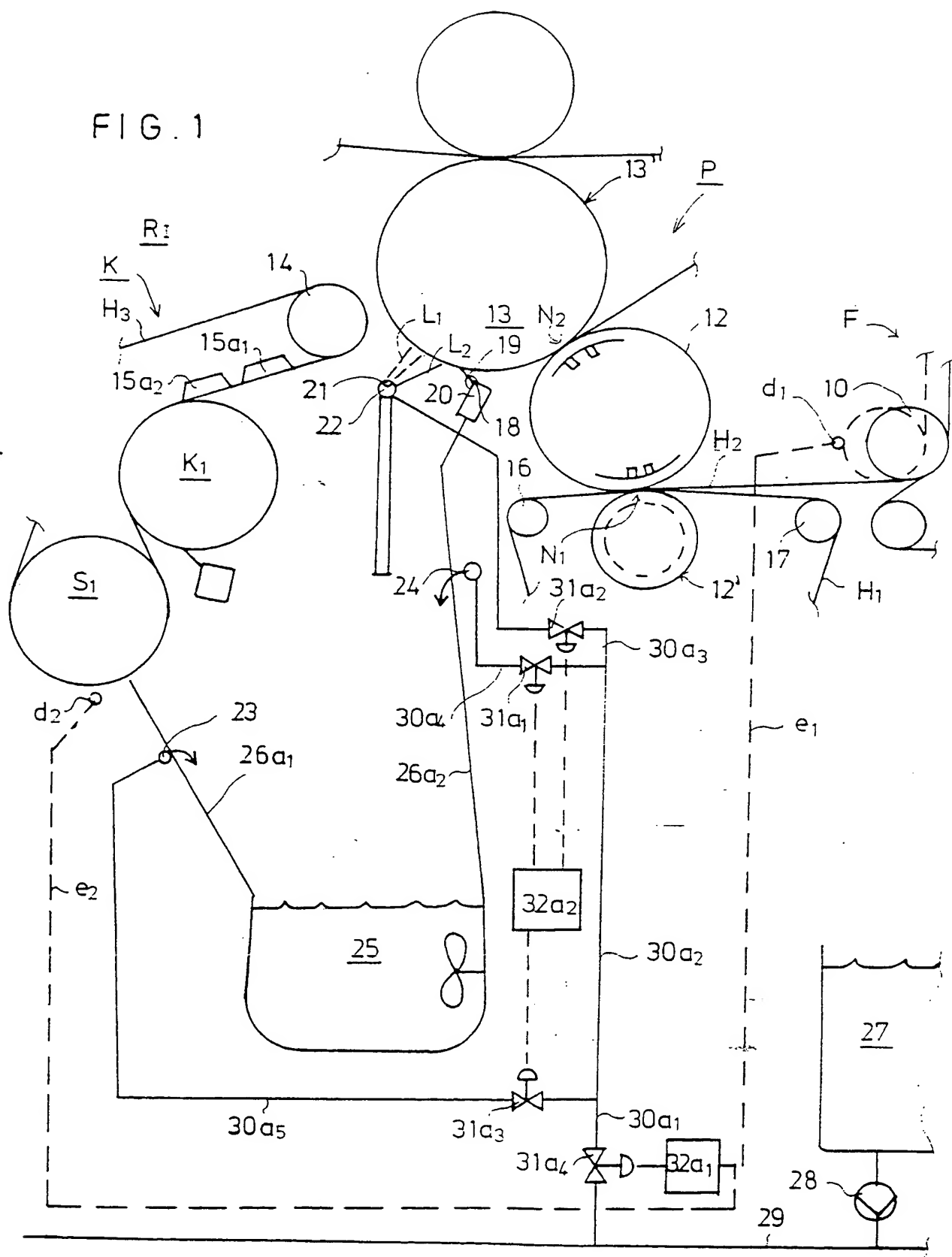
13. A method as claimed in any of the preceding claims, **characterized** in that, when the web (W) is passed into the pulper (25) as non-disrupted, drawing of the web into the pulper is produced by means of separate medium jets (S_1, S_2) while the web is affixed to the jets (S_1 and/or S_2) by means of a Coanda effect.

14. A method as claimed in any of the preceding claims, **characterized** in that, in the method, before the web is disrupted by means of the needle jet (L_2), the web is moistened by means of a liquid jet (L_1) produced out of a second nozzle pipe (21).

15. A method as claimed in any of the preceding claims, **characterized** in that the nozzle pipe that produces the needle jets (L_2) is oscillated in the direction of width of the paper/board machine, in which connection the effect of disrupting the web produced by the needle jets is enhanced.

16. A method as claimed in any of the preceding claims, **characterized** in that the medium jets (S_1, S_2, S_3) and the jets (L_2) that disrupt the web and the web moistening jet (L_1) receive their control from separate detector devices (D_1, D_2), which monitor the running of the web in connection with the dryer section and/or the position of the pick-up roll before the press section.

FIG. 1



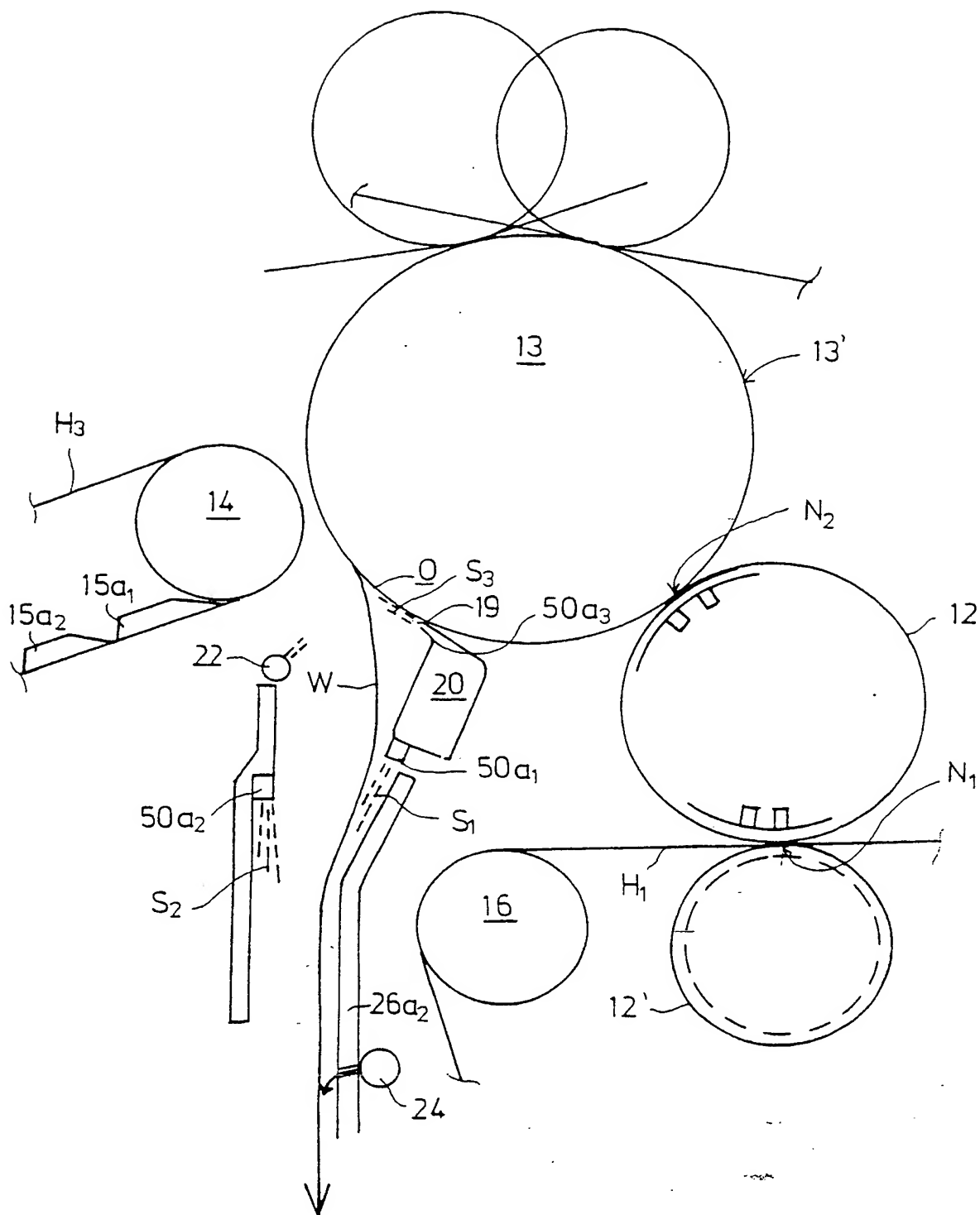


FIG. 2

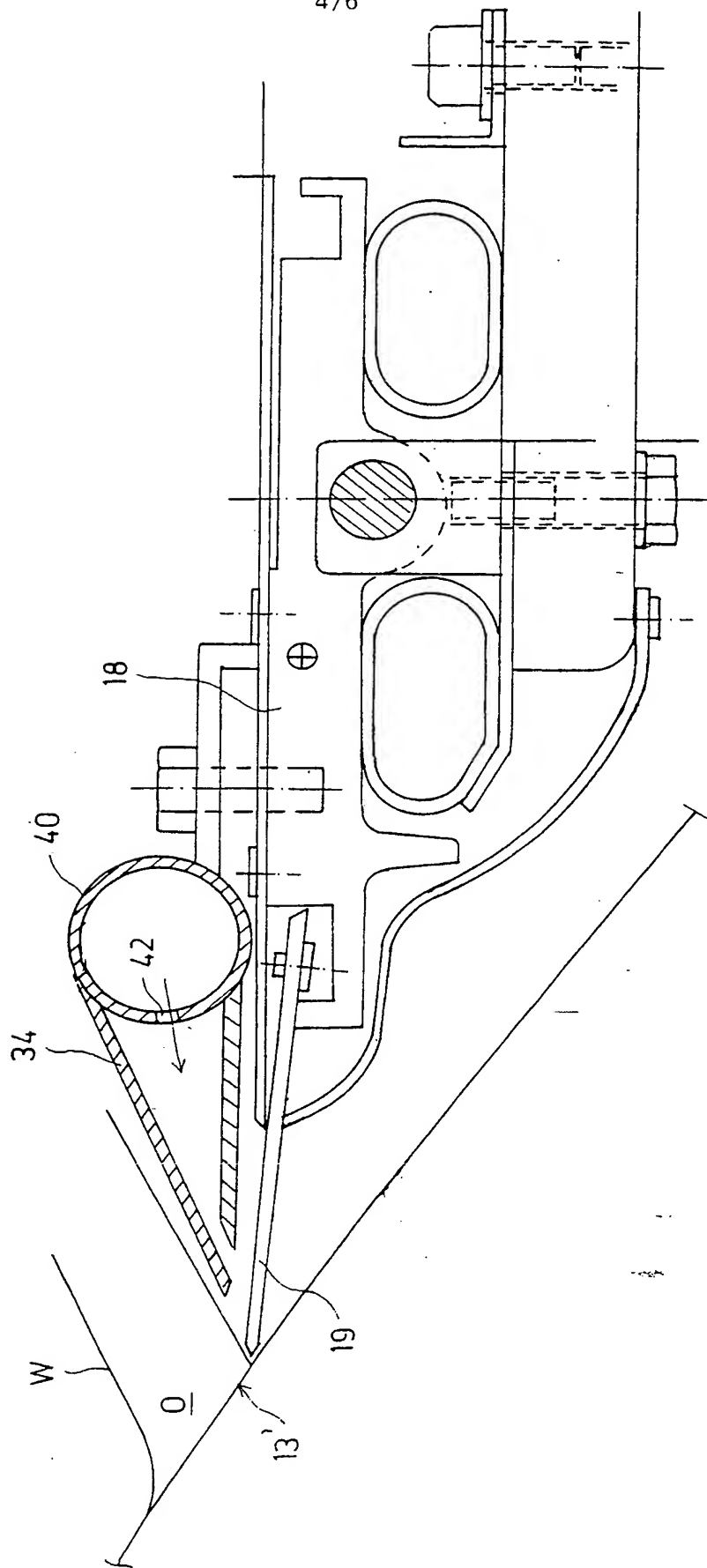


FIG. 3B

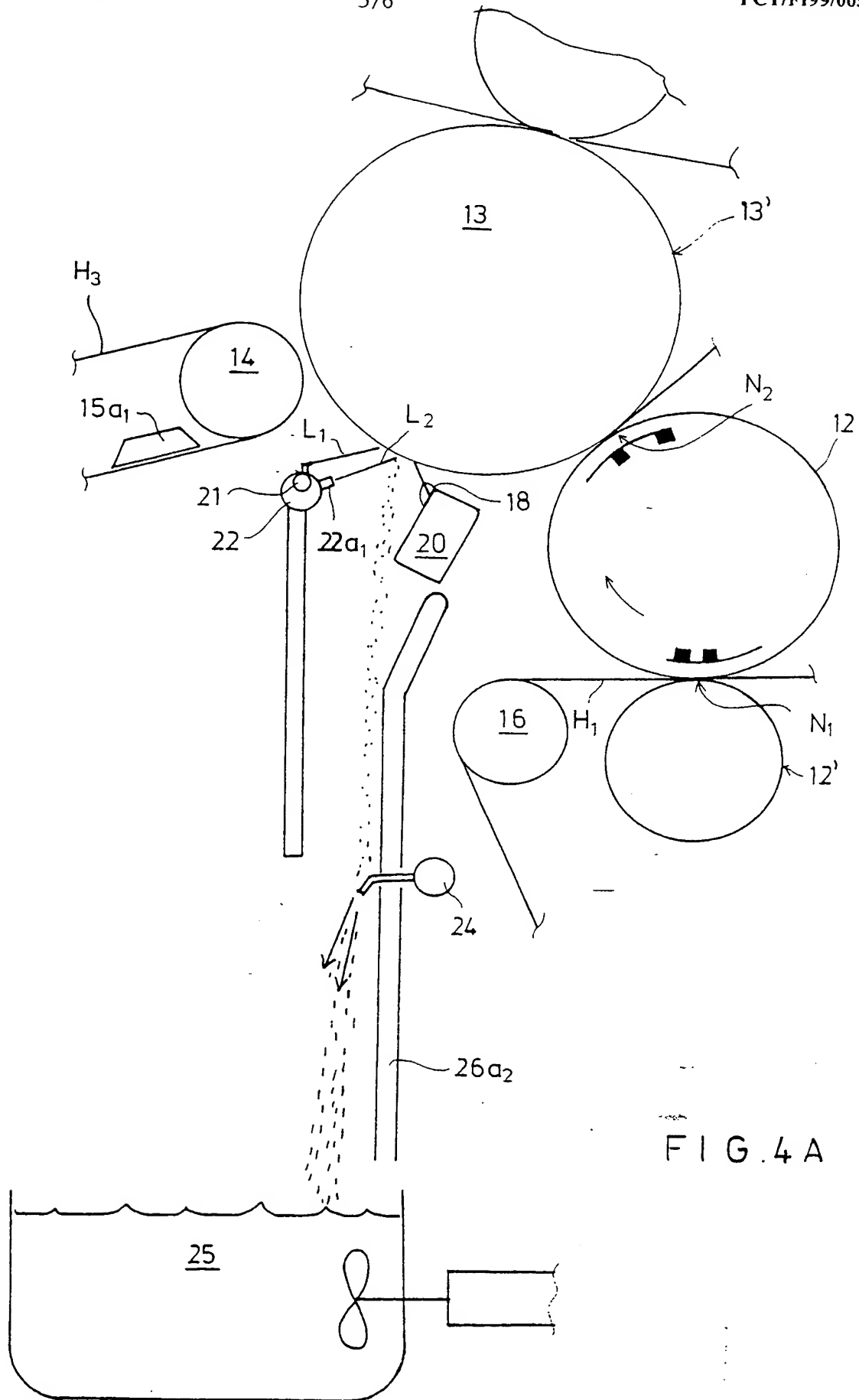


FIG. 4A

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 99/00560

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21G 3/00, D21G 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21G, D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5234172 A (DAVID E. CHUPKA ET AL), 10 August 1993 (10.08.93), column 2, line 36 - line 55, figure 8, abstract	1-2,11,15-16
A	--	3-10,12-14
X	US 4182170 A (HANS GRUPP), 8 January 1980 (08.01.80), figure 18, claim 1, abstract	1,11
A	--	2-10,12-16
A	SE 414517 B (SUNDS DEFIBRATOR AB), 4 August 1980 (04.08.80), figure 2, abstract	5-8
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

2 November 1999

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FI 93183 B (VALMET PAPER MACHINERY INC.), 30 November 1994 (30.11.94), claim 6, abstract --	10
A	US 2888073 A (WESLEY S. CORBIN ET AL), 26 May 1959 (26.05.59), abstract -- -----	1-16

